

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-IV (NEW) EXAMINATION – WINTER 2018

Subject Code: 2143406

Date: 22/11/2018

Subject Name: Thermo Dynamics and Thermal Eng.

Time: 02:30 PM TO 05:00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a) Write a short note on p-T (Pressure – Temperature) diagram for pure substance. 03
- (b) Differentiate between open system, closed system and an isolated system. 04
- (c) A fluid system, contained in a piston and cylinder machine, passes through a complete cycle of four processes. The sum of all heat transferred during a cycle is – 340 kJ. The system completes 200 cycles per min. 07
- Complete the following table showing the method for each item, and compute the net rate of work output in kW.

Process	Q(KJ/min)	W(KJ/min)	dU(KJ/min)
1-2	0	4340	-----
2-3	42000	0	-----
3-4	-4200	-----	-73200
4-1	-----	-----	-----

- Q.2 (a) State kelvin plank statement and Clausius statement for II law of thermodynamics 03
- (b) Write a short note on modified Rankine cycle. 04
- (c) State the methods of increasing the thermal efficiency of a Rankine cycle. 07

OR

- (c) Explain Constant Pressure or Diesel Cycle also find the air Standard efficiency of Diesel Cycle. 07
- Q.3 (a) Define Thermal efficiency, Relative efficiency & Volumetric efficiency. 03
- (b) Derive the Maxwell relations and explain their importance in thermodynamics. 04
- (c) Derive and Explain Clausius-Claperyon Equation with p-T Diagram 07

OR

- Q.3 (a) Differentiate between the energy and exergy. 03
- (b) Write short note on entropy. 04
- (c) Define the Joule Thomson coefficient. State the conditions for cooling effect, heating effect and neither cooling nor heating effect. 07
- Q.4 (a) Define Available and Unavailable energy. 03
- (b) Write a short note on Gibbs-Dalton law 04
- (c) Show that for $pv^\gamma = \text{Const}$ for Reversible Adiabatic Process 07

OR

- Q.4 (a) Differentiate between ideal and real gases. 03
- (b) Write a short note on Compressibility chart 04
- (c) 8 Kg of air at 650 K and 5.5 bar pressure is enclosed in a closed system. If the atmospheric temperature and pressure are 300 K and 1 bar respectively, determine: 07
- The availability if the system goes through the ideal work producing process.
- The availability and effectiveness if the air is cooled at constant pressure to atmospheric temperature without bringing it to complete dead state. Take $c_v = 0.718 \text{ kJ/Kg K}$; $c_p = 1.005 \text{ kJ/Kg K}$

- Q.5 (a) State Fourier's law of heat conduction with mathematical expression. **03**
(b) Derive the mathematical expression for the Critical insulation thickness. **04**
(c) The inner surface of a plane brick wall is at 60°C and the outer surface is at 35°C. Calculate the rate of heat transfer per m² of surface area of the wall, which is 220 mm thick. The thermal conductivity of the brick is 0.51 W/m°C. **07**

OR

- Q.5 (a) Define black body, white body & gray body. **03**
(b) Differentiate free convection and forced Convection. **04**
(c) Using Clausius - Clapeyron's equation, estimate the enthalpy of vaporization **07**
The following data is given : At 200°C : $v_g = 0.1274 \text{ m}^3/\text{kg}$; $v_f = 0.001157 \text{ m}^3/\text{kg}$; $\left(\frac{dp}{dT}\right) = 32 \text{ kPa/K}$

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